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TITLE OF THE INVENTION

METHOD AND SYSTEM FOR COMMUNICATING WITH A DEVICE ATTACHED TO
A COMPUTER USING ELECTRONIC MAIL MESSAGES

CROSS-REFERENCES TO RELATED APPLICATIONS

The present application is related to U.S. Patent Application 08/883,492 filed June 26, 1997 entitled "Method and System for Diagnosis and Control of Machines Using Connectionless Modes Having Delivery Monitoring and an Alternate Communication Mode," U.S. Patent Application 08/820,633 filed March 19, 1997 entitled "Method and System to Diagnose a Business Office Device Based on Operating Parameters Set by a User," U.S. Patent Application 08/733,134 filed October 16, 1996 entitled "Method and System for Diagnosis and Control of Machines Using Connectionless Modes of Communication," U.S. Patent Application 08/624,228 filed March 29, 1996, now U.S.P. 5,818,603, entitled "Method and System for Controlling and Communicating with Machines Using Multiple Communication Formats," U.S. Patent Applications 08/738,659 and 08/738,461, both of which are entitled "Method and System for Diagnosis and Control of Machines Using Connection and Connectionless Modes of Communication," filed October 30, 1996, and are divisions of U.S. Patent Application 08/463,002 filed June 5, 1995, entitled "Method and System for Diagnosis and Control of Machines Using Connection and Connectionless Modes of Communication", now U.S.P. 5,819,110, and U.S. Patent Application 08/852,413 filed May 7, 1987, entitled "Method and System for Controlling and Communicating with Business Office Devices," now U.S.P. 5,774,678, which is a continuation of U.S. Patent Application 08/698,068 filed August 15, 1996, entitled "Method and Apparatus for

Controlling and Communicating With Business Office Devices", now U.S.P. 5,649,120 which is a continuation of U.S. Patent Application 08/562,192 filed November 22, 1995, which is a continuation of U.S. Patent Application 08/473,780 filed June 6, 1995, entitled "Method and Apparatus for Controlling and Communicating With Business Office Devices", now U.S.P. 5,544,289, which is a continuation of U.S. Patent Application 08/426,679 filed April 24, 1995, now U.S.P. 5,537,554, entitled "Method and Apparatus for Controlling and Communicating With Business Office Devices" which is a continuation of U.S. Patent Application 08/282,168 filed July 28, 1994 and entitled "Method and Apparatus for Controlling and Communicating With Business Office Devices", now U.S. Patent 5,412,779, which is a continuation of U.S. Patent Application 07/902,462 filed June 19, 1992, now abandoned, which is a continuation of U.S. Patent Application 07/549,278, filed July 6, 1990, now abandoned, the disclosure of each is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention generally relates to the use of electronic mail messages for communicating information to and from a device connected to a computer. The invention is more particularly related to the processing performed within the computer in order to forward the appropriate information to or from the device. The invention is further related to a method and system for receiving an electronic mail message by the computer and determining if the electronic mail message contains information which is designated for the attached device. Still further, the invention is related to the transmission of information

originating from a device attached to a computer using electronic mail as a transmission device.

Discussion of the Background

Electronic mail ("email") has become very popular for communicating information between people and provides the benefits of being inexpensive and convenient to a user. Extensive information and protocols are available explaining how email including Internet email operates and many commercially available programs are available to implement email functions.

While there exists many commercially available programs specifically designed to communicate electronic mail messages between humans, there are no known commercially available email programs for communicating information which originates from or is intended to be delivered to control a machine.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a method, system, and computer program product for implementing communication using electronic mail messages.

It is another object of this invention to provide a method, system, and computer program product in which a message is received from, processed by, and transmitted to a device connected to the computer which receives the electronic mail message.

It is yet another object of the invention to provide a method, system, and computer program product which transmits information originating from a device through a computer.

These and other objects are accomplished by a method, system, and computer program product in which an electronic mail message is received by a computer. When it is determined that the electronic mail message contains information for a device associated with the computer, a communication is transmitted from the computer to the device. In an embodiment of the invention, a person may read the email to determine that the email is for the attached device. The user may then manually perform an action which causes information to be transmitted from the computer to the device. Such an action by a user may include executing a file attached to an electronic mail message which causes a device driver to transmit the appropriate information to the attached device. The device may be any type of device including a business office device, a digital camera, or any other electronic device which is desired to be remotely monitored and/or controlled including equipment for remotely monitoring and controlling utility meters.

As an alternative way of forwarding information from an email message to an attached device, the computer may automatically analyze a received email and determine that information is to be transmitted to the device, without any type of user invention. A program which monitors received email may be executing in the computer and this program may determine that the received email message is for the device by detecting a code within the message. Such a function may be implemented by monitoring the subject of the message or alternatively detecting a code which exists in the body of the message, for example.

The invention also relates to the transmission of an outgoing email message from the computer containing information from the attached device. Information from the device may be transmitted to a device driver of the computer and subsequently to a Messaging Application Programming Interface ("MAPI") of the computer. If desired, the transmission of

the electronic mail message from the device may establish a TCP ("Transmission Control Protocol") connection between the computer which functions as a message transfer agent. As a further alternative, one or more files may be created within the computer and these files may be written to a mail spool directory of the computer. When the computer detects the existence of the file(s) in the mail spool directory, an email message is transmitted from the computer.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 illustrates three networked business office machines connected to a network of computers and data bases through the Internet;

Figure 2 illustrates the components of a digital copier/printer;

Figure 3 illustrates the electronic components of the digital copier/printer illustrated in Figure 2;

Figure 4 illustrates details of the multi-port communication interface illustrated in Figure 3;

Figure 5 illustrates an alternative system configuration in which business office devices are connected to a computer which is connected to a network, and also devices which are connected directly to the network;

Figure 6A illustrates in block diagram format a manner in which information may be communicated to or from a device using electronic mail;

Figure 6B illustrates an alternative way of communicating using electronic mail in which the computer which is connected to the device also serves as a message transfer agent;

Figure 7 illustrates an alternative manner of sending messages across the Internet;

Figure 8 illustrates an exemplary computer which may be connected to the device and used to communicate electronic mail messages;

Figure 9 illustrates in block diagram format modules, objects, and information which are contained within a computer;

Figure 10 illustrates information of a device driver which may be used with this invention;

Figure 11A illustrates an exemplary email message and Figure 11B illustrates an executable file which may be attached to the email message of Figure 11A;

Figure 12 illustrates a screen display of an email message;

Figure 13 illustrates a method of receiving an email message according to a first embodiment of the invention;

Figure 14 illustrates a method of receiving an electronic mail message according to a second embodiment of the invention;

Figure 15 illustrates a method of transmitting an electronic mail message according to an embodiment of the invention;

Figure 16 illustrates an alternative method of transmitting information according to a second embodiment of the invention;

Figure 17 illustrates a data structure containing device information;

Figure 18 illustrates a log of trouble information which has occurred in various business office devices;

Figure 19 illustrates query results of information relating to a specific printer; and

Figure 20 illustrates an exemplary monthly report generated by the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, wherein like numerals designate identical or corresponding parts throughout the several views, and more particularly to Figure 1 thereof, there is illustrated a figure showing various machines and computers for monitoring, diagnosing and controlling the operation of the machines. In Figure 1, there is a first network 16, such as a Local Area Network (LAN) connected to computer workstations 17, 18, 20 and 22. The workstations can be any type of computers including IBM Personal Computer compatible devices, Unix based computers, or Apple Macintoshes. Also connected to the network 16 are a digital copier/printer 24, a facsimile machine 28, and a printer 32. The devices 24, 28 and 32 are referred to as machines or monitored devices and other types of devices may be used as the machines or monitored devices, including any of the devices discussed below. Also, a facsimile server (not illustrated) may be connected to the network 16 and have a telephone, ISDN (Integrated Services Digital Network), or cable connection. In addition to the digital copier/printer 24, facsimile machine 28, and printer 32 being connected to the network 16, these devices may also include conventional telephone and/or ISDN and/or cable connections 26, 30 and 34, respectively. As is explained below, the business office machines or business devices 24, 28 and 32 communicate with a remote

monitoring, diagnosis and control station, also referred to as a monitoring device, through the Internet via the network 16 or by a direct telephone, ISDN, or cable connection.

In Figure 1, the Internet is generally designated by 10. The Internet 10 includes a plurality of interconnected computers and routers designated by 12A-12B. The manner of communicating over the Internet is known through RFC documents obtained by FTP at
5 NIC.DDN.MIL or at FTP NISC.SRI.COM. TCP/IP related communication is described for example in the book "TCP/IP Illustrated," Vol. 1, The Protocols, by Stevens, from Addison-Wesley Publishing Company, 1994, which is incorporated herein by reference.

In Figure 1, a firewall 14 is connected between the Internet 10 and the network 16. A
10 firewall is a device that allows only authorized computers to access a network or other computer via the Internet. Firewalls are known and commercially available devices and/or software and, for example, include SunScreen from Sun Microsystems Inc. Similarly, a firewall 50 is connected between the Internet 10 and a network 52. Also, a firewall 40 is connected between the Internet 10 and a workstation 42.

The network 52 is a conventional network and includes a plurality of workstations 56,
62, 68 and 74. These workstations may be different departments within a company such as a marketing, manufacturing, design engineering and customer service departments. In addition to the workstations connected via the network 52, there is a workstation 42 which is not directly connected to the network 52. Information in a data base stored in a disk 46 may be
20 shared using proper encryption and protocols over the Internet to the workstations connected directly to the network 52. Also, the workstation 42 includes a direct connection to a telephone line and/or ISDN and/or cable 44 and the data base in disk 46 may be accessed through the telephone line, ISDN, or cable. The cable used by this invention may be

implemented using a cable which typically is used to carry television programming, cable which provides for high speed communication of digital data typically used with computers or the like, or may be implemented using any desired type of cable.

Information of the business office machines 24, 28 and 32 may be stored in one or more of the data bases stored in the disks 46, 54, 58, 64, 70 and 76. Each of the customer service, marketing, manufacturing, and engineering departments may have their own data base or may share from one or more data bases. Each of the disks used to store data bases is a non-volatile memory such as a hard disk or optical disk. Alternatively, the data bases may be stored in any storage device including solid state and/or semiconductor memory devices. As an example, disk 64 contains the marketing data base, disk 58 contains the manufacturing data base, disk 70 contains the engineering data base and disk 76 contains the customer service data base. Alternatively, the disks 54 and 46 store one or more of the data bases.

In addition to the workstations 56, 62, 68, 74 and 42 being connected to the Internet, these workstations may also include a connection to a telephone line, ISDN, or cable which provides a secure connection to the machine being monitored diagnosed and/or controlled and is used during a connection-mode of communication. Additionally, if one of the Internet, telephone, ISDN, or cable is not operating properly, one of the others can be automatically used for communication.

A feature of the present invention is the use of a connectionless-mode of communication (e.g., Internet email) or transmission between a machine and a computer for diagnosing and controlling the machine. Alternatively, the email which is transmitted may be implemented using a connection mode of communication. The IBM Dictionary of Computing by George McDaniel, 1994, defines a connectionless-mode transmission to be the

transmission of a single unit of data from a source service access point to one or more destination service access points without establishing a connection. The IBM Dictionary also defines a connection-mode transmission to be the transmission of units of data from a source service access point to one or more destination service access points via a connection. The connection is established prior to data transfer and released following data transfer.

Additional information about the connection-mode and the connectionless-mode of operation is described in the Handbook of Computer-Communications Standards, Vol. 1, 2nd Edition, by William Stallings, 1990, which is incorporated herein by reference. In order to transfer data from one DTE (Data Terminal Equipment) to another DTE, there is a unique identifier or address for each DTE. This unique identifier or address is usable in both connectionless-modes and connectionless-modes of communication.

Figure 2 illustrates the mechanical layout of the digital copier/printer 24 illustrated in Figure 1. In Figure 2, 101 is a fan for the scanner, 102 is a polygonal mirror used with a laser printer, and 103 designates an F θ lens used to collimate light from a laser (not illustrated). Reference numeral 104 designates a sensor for detecting light from the scanner, 105 is a lens for focusing light from the scanner onto the sensor 104, and 106 is a quenching lamp used to erase images on the photoconductive drum 132. There is a charging corona unit 107 and a developing roller 108. Reference numeral 109 designates a lamp used to illuminate a document to be scanned and 110, 111 and 112 designate mirrors used to reflect light onto the sensor 104. There is a drum mirror 113 used to reflect light to the photoconductive drum 132 originating from the polygon mirror 102. Reference numeral 114 designates a fan used to cool the charging area of the digital copier/printer, and 115 is a first paper feed roller used for feeding paper from the first paper cassette 117, and 116 is a manual

feed table. Similarly, 118 is a second paper feed roller for the second cassette 119.

Reference numeral 120 designates a relay roller, 121 is a registration roller, 122 is an image density sensor and 123 is a transfer/separation corona unit. Reference numeral 124 is a cleaning unit, 125 is a vacuum fan, 126 illustrates a transport belt, 127 is a pressure roller, and 128 is an exit roller. Reference numeral 129 is a hot roller used to fix toner onto the paper, 130 is an exhaust fan and 131 is the main motor used to drive the digital copier.

Figure 3 illustrates a block diagram of the electronic components illustrated in Figure 2. The CPU 160 is a microprocessor and acts as the system controller. There is a random access memory 162 to store dynamically changing information including operating parameters of the digital copier. A read only memory 164 stores the program code used to run the digital copier and also information describing the copier (static-state data) such as the model number, serial number of the copier, and default parameters.

There is a multi-port communication interface 166 which allows the digital copier to communicate with external devices. Reference numeral 168 represents a telephone, ISDN, or cable line and 170 represents a network. Further information of the multi-port communication interface is described with respect to Figure 4. An interface controller 172 is used to connect an operation panel 174 to a system bus 186. The operation panel 174 includes standard input and output devices found on a digital copier including a copy button, keys to control the operation of the copier such as number of copies, reduction/enlargement, darkness/lightness, etc. Additionally, a liquid crystal display may be included within the operation panel 174 to display parameters and messages of the digital copier to a user.

A storage interface 176 connects storage devices to the system bus 186. The storage devices include a flash memory 178 which can be substituted by a conventional EEPROM and a disk 182. The disk 182 includes a hard disk, optical disk, and/or a floppy disk drive. There is a connection 180 connected to the storage interface 176 which allows for additional memory devices to be connected to the digital copier. The flash memory 178 is used to store semi-static state data which describes parameters of the digital copier which infrequently change over the life of the copier. Such parameters include the options and configuration of the digital copier. An option interface 184 allows additional hardware such as an external interface to be connected to the digital copier. A clock/timer 187 is utilized to keep track of both the time and date and also to measure elapsed time.

On the left side of Figure 3, the various sections making up the digital copier are illustrated. Reference numeral 202 designates a sorter and contains sensors and actuators used to sort the output of the digital copier. There is a duplexer 200 which allows a duplex operation to be performed by the digital copier and includes conventional sensors and actuators. The digital copier includes a large capacity tray unit 198 which allows paper trays holding a large number of sheets to be used with the digital copier. The large capacity tray unit 198 includes conventional sensors and actuators.

A paper feed controller 196 is used to control the operation of feeding paper into and through the digital copier. A scanner 194 is used to scan images into the digital copier and includes conventional scanning elements such as a light, mirror, etc. Additionally, scanner sensors are used such as a home position sensor to determine that the scanner is in the home position and a lamp thermistor to ensure proper operation of the scanning lamp. There is a printer/imager 192 which prints the output of the digital copier and includes a conventional

laser printing mechanism, a toner sensor, and an image density sensor. The fuser is used to fuse the toner onto the page using a high temperature roller and includes an exit sensor, a thermistor to assure that the fuser is not overheating, and an oil sensor. Additionally, there is an optional unit interface 188 used to connect to optional elements of the digital copier such as an automatic document feeder, a different type of sorter/collator, or other elements which can be added to the digital copier.

Figure 4 illustrates details of the multi-port communication interface 166. The digital copier may communicate to external devices through a Centronics interface 220 which receives or transmits information to be printed, a cable modem unit 221 which has a high speed connection over cable, a SCSI interface 222, a conventional telephone interface 224 which connects to a telephone line 168A, an ISDN interface 226 which connects to an ISDN line 168B, an RS-232 interface 228, and a LAN interface 230 which connects to a LAN 170. A single device which connects to both a Local Area Network and a telephone line is commercially available from Megahertz and is known as the Ethernet-Modem.

The CPU or other microprocessor or circuitry executes a monitoring process to monitor the state of each of the sensors of the digital copier, and a sequencing process is used to execute the instructions of the code used to control and operate the digital copier. Additionally, there is a central system control process executed to control the overall operation of the digital copier and a communication process used to assure reliable communication to external devices connected to the digital copier. The system control process monitors and controls data storage in a static state memory such as the ROM 164 of Figure 3, a semi-static memory such as the flash memory 178 or disk 182, or the dynamic state data which is stored in a volatile or non-volatile memory such as the RAM 162 or the

flash memory or disk 182. Additionally, the static state data may be stored in a device other than the ROM 164 such as a non-volatile memory including either of the flash memory 178 or disk 182.

5 The above details have been described with respect to a digital copier but the present invention is equally applicable to other business office machines or devices such as an analog copier, a facsimile machine, a scanner, a printer, a facsimile server, or other business office machines. Additionally, the present invention includes other types of machines which operate using a connection-mode or connectionless-mode of communication, and also email, such as a metering system including a gas, water, or electricity metering system, vending machines, or any other device which performs mechanical operations, such as automobiles, has a need to be monitored, and performs a function. In addition to monitoring special purpose machines, and computers, the invention can be used to monitor, control, and diagnose a general purpose computer which would be the monitored and/or controlled device.

10 Figure 5 illustrates an alternative system diagram of the invention in which different devices and sub-systems are connected to the Internet 10. However, there is no requirement to have each of these devices or sub-systems as part of the invention but any individual component or subsystem illustrated in Figure 5 is also part of the invention. Further, the elements illustrated in Figure 1 may be connected to the Internet 10 which is illustrated in Figure 5. In Figure 5, there is illustrated a fire wall 250 connected to an intranet 252. One of 20 the computers or devices connected to the intranet 252 is a service machine 254 which includes therein or has connected thereto data 256 which may be stored in a data base format. The data 256 includes history, performance, malfunction, and any other information including statistical information of the operation or failure or set-up and components or

optional equipment of devices which are being monitored. The service machine 254 may be implemented as the device or computer which requests the monitored devices to transmit data or which requests that remote control and/or diagnosis tests be performed on the monitored devices. The service machine 254 may be implemented as any type of device and is
5 preferably implemented using a computerized device such as a general purpose computer.

Another sub-system of Figure 5 includes a fire wall 258, an intranet 260, and a printer 262 connected thereto. In this sub-system, there is not a separate general purpose computer connected between the intranet 260 (or a different type of computer network) but the functions of sending and receiving electronic mail messages by the printer 262 (and similarly by a copier 286) are performed by circuitry, a microprocessor, or any other type of hardware contained within or mounted to the printer 262.

An alternate type of sub-system includes the use of an Internet service provider 264 which may be any type of Internet service provider including known commercial companies such as America Online, Netcom, CompuServe, Niftyserve, the Internet service provider Erols, or any other Internet service provider. In this sub-system, a computer 266 is connected to the Internet service provider 264, through a modem, for example, such as a telephone line modem, a cable modem, modems which use any type of wires such as modems used over an ISDN (Integrated Services Digital Network) line, ASDL (Asymmetric Digital Subscriber Line), modems which use frame relay communication, any digital or analog modem, wireless
20 modems such as a radio frequency modem, a fiber optic modem, or a device which uses infrared light waves. Further, a business office device 268 is connected to the computer 266. As an alternative to the business office device 268 (and any other device illustrated in Figure 5), a different type of machine may be monitored or controlled such as a digital copier, any

type of appliance, security system, or utility meter such as an electrical, water, or gas utility meter, or any other device discussed herein.

Also illustrated in Figure 5 is a fire wall 270 connected to a network 274. The network 274 may be implemented as any type of computer network, such an Ethernet network, for example. Networking software which may be used to control the network includes any desires networking software including software commercially available from Novell or Microsoft. The network 274 may be implemented as an Intranet, if desired. A computer 272 connected to the network 274 may be used to obtain information from a business office device 278 and generate reports such as reports showing problems which occurred in various machines connected to the network and a monthly usage report of the devices connected to the network 274. In this embodiment, a computer 276 is connected between the business office device 278 and the network 274. This computer receives email communications from the network and forwards the appropriate commands or data, or any other information, to the business office device 278. While it has been stated that the business office device 278 is connected to the computer 276, there is no requirement for a wired connection between the business office device and the computer and communication between the business office device 278 and the computer 276 may be accomplished using wires or wireless methods including through the use of radio frequency connections and light connections which may be through an infrared connection, or through fiber optics. Similarly, each of the various networks and intranets illustrates in Figure 5 may be established using any desired manner including through the establishment of wireless networks such as radio frequency networks. The wireless communication described herein may be established using spread spectrum techniques including techniques which use a spreading code and frequency

hopping techniques such as the frequency hopping wireless network which is disclosed in the Bluetooth Specification which is described at the world wide web site www.bluetooth.com, which is incorporated herein by reference.

Another sub-system illustrated in Figure 5 includes a fire wall 280, an intranet 284, a computer 282 connected thereto, and a copier 286. The computer 282 may be used to generate reports and request diagnostic or control procedures. These diagnostic and control procedures may be performed with respect to the copier 286 or any of the other devices illustrated in or used with Figure 5. While Figure 5 illustrates a plurality of fire walls, the fire walls are preferable but optional equipment and therefore the invention may be operated without the use of fire walls, if desired.

Figure 6A illustrates a device 300 connected to a typical email exchange system which includes components 302, 304, 306, 308, 310, 312, 314, 316, and 318 which may be implemented in a conventional manner and are taken from Figure 28.1 of Stevens, above. The device 300 may be any of the devices described herein and the user at a terminal 302 may correspond to any of the illustrated computers, such as the computer 276 illustrated in Figure 5. While Figure 6A illustrates the user at a terminal 302 as being a sender, the sending and receiving functions may be reversed in Figure 6A. Further, if desired, there may not be a need for having a user at the terminal. Connected to the user at a terminal 302 is the user agent 304. Popular user agents for Unix include MH, Berkeley Mail, Elm, and Mush. The user agent creates email messages to be sent and if desired, places these messages to be sent in a queue 306. The mail to be sent is forwarded to a Message Transfer Agent (MTA) 308. A common MTA for Unix systems is Sendmail. Typically, the message transfer agents 308 and 312 exchange communications using a TCP (Transfer Communication Protocol)

connection or a TCP/IP (Internet Protocol) connection or protocol. It is to be noted that the communication between the message transfer agents 308 and 312 may occur over the Internet, but alternatively may occur over any type of connection including any network connection such as a local area network, wide area network and/or an intranet. Further, any
5 desired connection between the message transfer agents 308 and 312 may be utilized.

From the message transfer agents 312, email messages are stored in user mailboxes 314 which are transferred to the user agent 316 and ultimately transmitted to the user at a terminal 318 which functions as a receiving terminal.

The TCP provides a connection-mode of transmission. However, a direct connection is usually not established between the sending terminal 302 and receiving terminal 318. Thus, the transmission of an electronic mail message may be considered a connectionless-mode of communication when it is being referred to as between two users or terminals, but when considering the transfer between MTAs, the communication is usually a connection-mode of communication.

As the Internet is a network accessible by many people and organizations, it is not considered to be secure. Therefore, messages transmitted over the Internet should be encrypted to keep the messages confidential. Encryption mechanisms are known and commercially available which may be used with the present invention. For example, a C library function, crypt(), is available from Sun Microcomputers for use with the Unix
20 operating system, and other encryption and decryption routines are known and commercially available and may also be used with this invention.

As an alternative to the general structure of Figure 6A, a single computer may be used which functions as the user terminal, and also the message transfer agent. As illustrated in

Figure 6B, the device 300 is connected to a computer 301 which includes the message transfer agent 308. If desired, the other components on the sending side of Figure 6A may be included in the computer 301 of Figure 6B including the user agent 304 and the queue of mail to be sent 306.

5 Figure 7 illustrates an alternative implementation of transferring mail and is based on Figure 28.3 of Stevens. Figure 7 illustrates an electronic mail system having a relay system at each end. The arrangement of Figure 7 allows one system at an organization to act as a mail hub. In Figure 7, there are four MTAs connected between the two user agents 304 and 318. These MTAs include local MTA 322, relay MTA 328, relay MTA 332, and local MTA 340. The most common protocol used for mail messages is SMTP (Simple Mail Transfer Protocol) which may be used with this invention, although any desired mail protocol may be utilized. In Figure 7, 320 designates a sending host which includes the user at a terminal 302, the user agent 306, and the local MTA 322. The device 300 is connected to, or alternatively included within, the sending host 320. Other local MTAs include local MTA 324 and 326. Mail to be transmitted and received may be queued in a queue of mail 330 of the relay MTA 328. The messages are transferred across the TCP connection 310, which may be, for example, the Internet, or may be any other type of network or connection.

 The transmitted messages are received by the relay MTA 322 and if desired, stored in a queue of mail 334. The mail is then forwarded to the local MTA 340 of a receiving host
20 342. The mail may be placed in one or more of the user mailboxes 314 and subsequently forwarded to the user agent 316 and finally forwarded to the user at a terminal 318. If desired, the user may not be required to be at the terminal and the mail may be directly forwarded to the terminal without user interaction. Other local MTAs at the receiving side

include MTA 338 and local MTA 336 which may have their own mailboxes, user agents, and terminals.

The various computers utilized by the present invention including the computers 266, 276, and 286 of Figure 5 may be implemented as illustrated in Figure 8. Further, any other
5 computer utilized by this invention may be implemented in a similar manner to the computer illustrated in Figure 8, if desired, including the service machine 254, computer 272, and computer 282 of Figure 5. However, not every element illustrated in Figure 8 is required in each of these computers. In Figure 8, the computer 360 includes a CPU 362 which may be implemented as any type of processor including commercially available microprocessors from companies such as Intel, Motorola, Hitachi and NEC, for example. There is a working memory such as a RAM 364, and a wireless interface 366 which communicates with a wireless device 368. The communication between the interface 366 and device 368 may use any wireless medium such as radio waves, or light waves, for example. The radio waves may be implemented using a spread spectrum technique such as Code Division Multiple Access (CDA) communication or using a frequency hopping technique such as that disclosed in the Bluetooth specification.

There is a ROM 370, and a flash memory 371, although any other type of nonvolatile memory may be utilized in addition to or in place of the flash memory 371 such as an EPROM, or an EEPROM, for example. An input controller 372 has connected thereto a
20 keyboard 374 and a mouse 376. There is a serial interface 378 connected to a serial device 380. Additionally, a parallel interface 382 is connected to a parallel device 384, a universal serial bus interface 386 is connected to a universal serial bus device 388, and also there is an IEEE 1394 device, commonly referred to as a fire wire device, connected to an IEEE 1394

interface 398. The various elements of the computer 360 are connected by a system bus 390. A disk controller 396 is connected to a floppy disk drive 394 and a hard disk drive 392. A communication controller 406 allows the computer 360 to communicate with other computers, or send email messages, for example over a telephone line 402, or a network 404. An I/O (Input/Output) controller 408 is connected to a printer 410 and a hard disk 412, for example using a SCSI (Small Computer System Interface) bus. There is also a display controller 416 connected to a CRT (Cathode Ray Tube) 414, although any other type of display may be used including a liquid crystal display, a light emitting diode display, a plasma display, etc.

Figure 9 illustrates various objects such as software objects and modules contained within the computer 306. The computer 306 is connected to a mail server 430 through which mail is sent and received. The mail server 430 may be located at the Internet service provider 264 of Figure 5, may be located on a network, may be owned by the company owning the computer 360, or may even be located inside of the computer 360, for example. An email processor 432 is utilized to control the transmitting and receiving of electronic mail messages. The email processor may be implemented in any desired or known manner and may be based on commercially available electronic mail programs such as Microsoft's Outlook Express, or GroupWise by Novell, although any other email program may be used, if desired. As a specific implementation, the email system may retrieve email from the server using POP3 (Post Office Protocol) and to access the email server in order to send emails using SMTP (Simple Mail Transfer Protocol), although any other protocol may be used, if desired. If the computer 360 utilizes an operating system such as an operating system from Unix, then the computer will usually have an IP address and a mail system built-in.

Therefore, there may be no need to utilize the mail server 430 with such a system. A registry 434 contains various information of the system and may be implemented in the same or similar manner as the registry of Windows 95, Windows 98, and/or Windows NT, for example. Incoming mail information 436 may be utilized to store incoming mail.

5 Additionally, if desired the incoming mail information 436 may be implemented to store the POP3 location, and store file information about the incoming emails. Outgoing mail information 438 contains information regarding SMTP and file information for outgoing mail. A device driver 440, such as printer driver, scanner printer, or other driver, for example may be used to communicate with the device 442 which may be any type of device from which information is desired or to which information or control signals are to be sent. The device driver 440 is implemented to translate commands or signals from the email processor 432 to signals which are transmitted to the device 442 and vice versa. Alternatively, the email processor 432 may perform more of the processing functions and the device driver 440 may have more simple programming and few responsibilities. Further, any other implementation of the software may be utilized as long as the function of proper communication and control of the device 442 using email messages is performed.

A more detailed exemplary implementation of the device driver 440 of Figure 9 is illustrated in Figure 10. The device driver 440 includes a device function support module 454 which may be implemented to perform the conventional and/or desired functions of a device driver. The device driver 440 also includes a remote control and diagnostic module 452. If desired, the remote control and diagnostic module 452 may be implemented to perform some or all of the control and/or diagnostic functions which are described in the related patent and patent applications and are incorporated by reference above. By

implementing the control and diagnostic module 452 in the device driver 440, the cost of the device 442 may be reduced and the resources and capabilities of the device 442 may be eliminated or reduced such as by reducing the amount of memory in the device 442 such as DRAM (Dynamic Random Access Memory) or flash memory, for example. This reduced cost is possible as the hardware resources of the computer 360 may be utilized in place of constructing additional hardware to go into the device 442, if desired. Various information including log information and error information may be stored in a data base which includes device data 456 using any desired hardware and data or data base management software. Further, software within the device 442 may be reduced by increasing the functions performed by the device driver 440 including functions performed by the remote control and diagnostic module 452 and the device function support module 454. These two software modules may be implemented in one software module, if desired. Additionally, the software which keeps track of the usage of the device may be removed from the device itself and included in the device driver 440.

Figure 11A illustrates an exemplary email message utilized by the invention. In Figure 11A, lines 1-7 are part of the email header. Each header field contains a name, followed by a colon, followed by the field value. RFC (Request For Comments) 822 specifies the format and interpretation of the header fields, which is incorporated by reference. The fields of the header illustrated in Figure 11A are fairly standard and self-explanatory. Line 1 indicates from where the email originated, line 2 indicates the date the email was sent, line 3 indicates a name associated with the email address (Service Center), line 4 indicates to whom the email is addressed and line 5 indicates the subject of the email message. Line 6 indicates the MIME version utilized by attachment encodings. MIME is

utilized to send binary files in electronic mail messages which permit only ASCII characters. MIME allows the binary encoding to be converted to these ASCII characters which are subsequently converted back to the original binary files at the appropriate time. Such a use of MIME encoding is well known. Line 7 designates one or more content fields such as the type of text, the length of the message and any other desired information.

Additionally, email messages also contain what is referred to as an envelope which is used by the message transfer agents for delivery. The envelope may be specified by SMTP commands such as "mail from" and "RCPT 2". Further information about the envelope is specified in RFC 821, which is incorporated herein by reference. A third part of an email message is the message body which is the content of the message. RFC 822 specifies the body as lines of ASCII text. In Figure 11A, the body is set forth in lines 9-18.

There may be files attached to electronic mail messages, for example as illustrated in Figure 11B. The attached file in Figure 11B is an executable file which allows a user to execute the programming code contained within the file. The attachment of files including executable files to electronic mail messages is a known feature of email messages.

Figure 12 illustrates a typical screen display of a computer executing an electronic mail program and displaying the email message of Figure 11A. When the Figure 11A is displayed, the various encoding information is not shown to the user but is displayed in an appropriate format. At the bottom of the display 470 is a section relating to attachments. The message displayed in Figure 12 shows an executable file "MAINTENANCE.EXE" as an attached file. As explained in the body or message of the email, by executing the attached file, the attached file will cause certain testing, gathering of information, controlling, or logging of information of the attached printer. Typically, the attached file is executed by

"clicking" or "double-clicking" on the attachment. Alternatively, the attachment may be saved as a separate file and then executed using the appropriate commands available within the operating system. Further, any other desired method may be used to execute the file.

Figure 13 illustrates a process of receiving an email message which is ultimately used to transmit information such as data, control commands, or diagnostic commands to an attached device according to a first embodiment of the invention. This method may be performed with any desired type of computerized or other type of hardware and/or software and may be performed using the hardware and software organization, as described above. In the embodiment of Figure 13, the email message is received in any conventional or desired manner and it is a manual action by the user which causes the email message to perform the desired operation. In Figure 13, after starting, the computer receives an incoming email message. In step 492, the user opens the email message in accordance with the requirements of the email program which is executing on the user's computer and in step 494, the message body of the email messages displays instructions and requests the user to execute the attached file. Step 494 corresponds to the display of Figure 12. Figure 12 shows that the message displays to the user the origin of the email message, the purpose of the email message, and how the user should execute the attached file in order to perform the desired operations. Alternatively, any desired message may be displayed to the user. The operations which are performed are determined by the attached file MAINTENANCE.EXE.

Step 496 determines if the user "clicked" the attached file which causes the attached file to be executed. Alternative manners of executing the attached file may be performed such as double clicking the attached file, saving the attached file, and using a command of the operating system to cause the file to execute, or the attached file may be executed in any other

way. After the user causes the execution of the attached file to begin, flow proceeds to step 498 which executes the attached file. In the preferred form of the invention, the attached file causes commands to be transmitted to the device driver. In step 500, the device driver receives the commands from the executing attachment and sends the appropriate commands and information to the attached device. In step 502, the operation specified by the attached file is performed by the device. Such an operation may be any type of operation including any of the operation, control functions, or data requests or manipulations described in any of the related patents and patent applications specified above. Exemplary operations performed by the device including remote control and diagnostic operations, the transmitting of information pertaining to the operation or failures which have occurred within the device, and also operating parameters utilized by or stored in the device.

While the process of Figure 13 has been explained with respect to the use of a device driver, the device driver is a convenient label for the routine which allows control of the attached device, and any other type of software which controls the attached device may be utilized in place of the device driver. For example, the email program itself may be able to send commands and/or data directly to the attached device. The attached device may be any of the devices which have been explained above.

One manner of causing the execution of the program code is to use a graphical pointing device such as a mouse connected to the computer, having the user place a pointer on the object representing the file (e.g., the attached file maintenance.exe), and subsequently having the user press a button while the user points to the file.

Figure 14 illustrates an alternative embodiment of receiving email messages in which the computer or program executing therein automatically detects that the incoming email

message is used for communication with the attached device. Thus, in this embodiment, there may be no need for the user to execute an attached file. In Figure 14, after starting, step 520 receives an incoming email message. In step 522, a program, such as an electronic mail processing program, detects that there is an incoming email message. The detection of incoming email may be performed in any desired manner. Currently, commercially available email programs have the capability to automatically detect incoming email messages and such conventional automatic detecting capabilities may be utilized. Further, in Unix, a specific directory labeled "/var/mail" which contains a file with a user name receives files corresponding to incoming email messages and when this file changes in size, appears, or more files appear, the system can detect that there is an incoming email message. In step 524, the executing program parsing the email to determine if the email is for the attached device. Such parsing is performed by determining if a predetermined code exists at a predetermined place in the email message. Exemplary positions of such a code may be in the subject line of the email message, may be a special code which appears within the message body, may be a code which appears in the message header, including a user defined field within the header, or may even be in the message envelope. It may also be possible for the incoming email message to have an address which is routed to the computer which is attached to the device and such messages are not displayed to the user but are directly used for processing. Step 526 performs an analysis of the parsed email to determine if the email is for the user or for the attached device. When the email is determined to be for the attached device, flow proceeds to step 528 which performs an operation in response to the email for the device. This performed operation may be any of the previously described operations including operations described in the related patents and patent applications including the performing of a mechanical action,

such as movement of a scanning head or printer head or causing any other type of mechanical actions typically performed by the device in question, and also operations including the transmitting of parameters.

When step 526 determines that the attached email is for a user (e.g., the email is unassociated with the attached device and is not used to control or monitor the attached device), flow proceeds from step 526 to step 530 which allows the user to view, reply to, forward, or perform any other desired function on this email. From steps 530 and 528, control flows to step 532 which determines if there are additional email messages. If there are more messages, flow proceeds back to step 524. If there are no more messages, the process of step 532 ends.

In addition to receiving electronic mail messages which are used for monitoring and/or controlling an attached device, the invention also includes the transmission of email messages which contain information of the device attached to the computer. The present invention prepares data for transmission in email messages, such as the information which is illustrated in Figures 17-20 which are explained below.

Figure 15 illustrates a first embodiment of transmitting an email message. After starting, the message is prepared to be transmitted in step 540. In order to prepare the message to be sent, data which is part of the message is obtained or generated. This data may be obtained by querying the device attached to the computer, or alternatively, is already stored in the computer. The data may also be obtained as disclosed in the related applications, if desired. The email message is prepared to have a format of conventional email systems including the envelope, header, and body of the email message, as explained above, although any desired format may be used.

Step 542 then sends the message to an outmail object. An outmail object is preferably a software object or routine executing within the computer which performs the transmission out of the computer. The manner in which the transmission is performed in the Microsoft Windows environment is through the use of the Messaging Application Programming Interface (MAPI). The MAPI allows interaction with messaging system and does not require a programmer to write all code which is utilized to transmit messages. By setting the MAPI in windows to a specific program, such as the Microsoft Outlook Express email program, when a message is transmitted to the outmail object (the MAPI client), the message transmission may become automated. Details regarding the implementation and use of MAPI are set forth in the book "Inside MAPI" by Irving De la Cruz and Les Thalaer, published by the Microsoft Press, 1996, which is incorporated herein by reference. Any feature regarding the use of MAPI disclosed in this book may be utilized to implement the present invention using the MAPI client. In step 544, the email message is transmitted out of the client, preferably using the outmail object.

The outmail object has been described as being the Windows MAPI. However, any other outmail object may be used to assist in the transmission of email messages. Alternatively, a software object does not have to be used but any desired code which assists in the transmission of the outmail object may be utilized.

An alternative manner of transmitting email messages according to the present invention is illustrated in Figure 16. The method of Figure 16 is preferably performed in a Unix environment, although any other software or operating system environment may be utilized as long as the desired steps are performed. In Figure 16, after starting, step 560 prepares the message to be sent. This step is utilized to obtain the information which is to be

transmitted and may be performed in a similar manner of step 540 of Figure 15 is performed, if desired. In step 562, the mail output files are prepared and include the message which was prepared in step 560. In step 564, the output files which may be one or more files, the number of files being the number appropriate to the operating system, are stored in an outgoing mail directory which in Unix is referred as the mail spool directory. This directory in Unix may be located at /var/spool/mqueue, although any other appropriate directory may be used. Once the appropriate file(s) is (are) stored in the desired location, step 566 is performed which transmits an electronic mail message corresponding to the file(s) which has been stored. The process of Figure 16 then ends.

Figure 17 illustrates a data structure 580 containing device information. This is information which is preferably transmitted from the device to the computer and/or from the computer out to a network using an email format. Figure 17 is an exemplary format and any desired format or information of the attached device which is of interest may be transmitted. The data structure 580 illustrated in Figure 17 includes a device identification 582, a model of the device 584, a device type 586 which indicates information such as whether the device is a scanner, digital copier, printer, fax machine, multifunction device, or any other information regarding the type of the device. Field 588 illustrates the capabilities of the device such as the optional equipment and capabilities of the device such as the type of output trays (e.g., a sorter), or whether the device has an automatic document feeder, for example, as explained in the related applications and patents. Further, information relating to the operation of the device may be transmitted. The information illustrated in Figure 17 relates to a printer, copier, or multifunction device, and different information may be utilized for different type of devices. Exemplary information which may be included in the device information data

structure 580 include a total number of page or paper jams 590, a total number of jobs which were performed 592, a total number of pages printed 594, a total number of color pages printed 596 which is applicable only to color printers or devices, an average number of pages per job 598, a number of jobs since the last report 600, a number of pages since the last report 606, a field 608 which stores information of the last 20 jobs including the time stamps related to when these jobs occurred, and a field 610 which includes information of the last 20 abnormal jobs (e.g., jobs which did not finish in accordance with normal or standard procedures) including the time stamps of when these jobs or abnormalities occurred, if desired.

The present invention may be utilized to create informational reports regarding status or other information of the device which is being monitored. The information of the devices may be transmitted over the Internet to another company or to a computer of the same company, or alternatively may be transmitted as an email which remains within the private network such as the local area network or a wide area network of a company. A machine which receives email messages prepared and transmitted in accordance with the teachings of this invention may be transmitted to a device such as the service machine 254 illustrated in Figure 5. The service machine may then notify an appropriate entity such as a third party service center, a service center of the device manufacturer such as the copier or printer manufacturer's service center or other authorized service center, or any other entity and indicate that a specific problem exists. Such notification may be performed through electronic mail, through a direct computer connection, through a telephone call to a person using a facsimile transmission, through the indication of a voice message, or in any other desired manner.

Figure 18 illustrates a log of collected data from various machines which indicates a problem with the machine. The log contains the identification of the machine which is having the problem, the location of the machine, the particular problem with the machine, and the entity which has been notified. The information which is received and transmitted in accordance with the log of Figure 18 may operate in accordance with the teachings of any of the cross-referenced applications. The log may be generated at and/or stored in any of the computers of Figure 5, for example.

Figure 19 illustrates an example of data which has been collected through an inquiry. The inquiry in the example of Figure 19 may be utilized to indicate the total number of installed machines of a particular model (e.g., the FT 6650), the number of these devices having a sorter, the average of number of copies per job per machine, and the average use of the sorter. Any other desired information may also be included in the status report. The status report may be generated at and/or stored in any of the computers of Figure 5, for example.

Figure 20 illustrates a monthly usage report 670. This report could have been generated for a computer network having four printers and three copiers which are located on the network. The report was preferably generated according to the teachings in this invention using email messages, although the report could also have been generated using the techniques described in the cross-referenced applications, if desired. The report of Figure 20 and the other reports and information providing capabilities of this invention may be generated by or stored within computer 272 of Figure 5. Alternatively, computer 282 of Figure 5 could be used to generate and/or store such a report. This type of report would allow in-company monitoring of machines which are connected to a network or intranet and the

computer maintaining information and statistics about the machines attached to the network may be part of the network, whether it be a local area network, wide area network, or across the Internet, for example. Alternatively, the report could be generated for machines on one of the networks 260, 274, or 284 by the service machine 254 which stores the appropriate
5 information in the data base 256.

In its preferred implementation, the present invention utilizes computers having separate housings than the device to which they are attached. This would allow the invention to be inexpensively implemented for installations which already have an existing computer for performing the desired processing as the new hardware costs may be reduced. Such an arrangement may also permit implementation of the invention without hardware changes to the device. However, if desired, the present invention may be implemented by including the appropriate processing and data storage capabilities in the device which is being monitored and/or controlled in addition to or as an alternative to a separate computer connected to the device. Further, this invention may be particularly applicable to existing installations such as a print server. A print server is connected to a computer network and receives requests to perform printing operations and distributes these printing operations to appropriate printing devices connected to the print server.

This application relates to and builds on various concepts which have been disclosed in the cross-referenced patents and patent applications which have been incorporated into this
20 application by reference. This patent application is intended to include not only the inventions disclosed in the related applications, but also the combinations of various features and functions of the individual embodiments which have been disclosed in this and each of the related applications. Thus, a feature disclosed in one of the related applications or patents

may be readily applied a concept disclosed in this invention, and also, the concepts disclosed in one or more of the other applications may be applied concepts or features disclosed in other(s) of the applications. Further, an email message may be used for only one of sending and receiving, with communication in the other direction being performed using a different
5 mode of communication, such as one of the other communication modes disclosed herein, or a communication mode disclosed in the related patents and patent applications.

This invention may be conveniently implemented using a conventional general purpose digital computer or microprocessor programmed according to the teachings of the present specification, as will be apparent to those skilled in the computer art. Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as will be readily apparent to those skilled in the art.

The present invention includes a computer program product which is a storage medium including instructions which can be used to program a computer to perform a process of the invention. The storage medium can include, but is not limited to, any type of disk including floppy disks, optical discs, CD-ROMs, and magneto-optical disks, ROMs, RAMs, EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for
20 storing electronic instructions.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope

of the appended claims, the invention may be practiced otherwise than as specifically described therein.

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